

## Rethinking the exchange rate disconnect puzzle theory in ASEAN-6

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### Article Info

#### Article history:

Received : 14 October 2017

Accepted : 29 March 2017

Published : 1 April 2017

#### Keywords:

dynamic panel data, monetary exchange rate model, foreign exchange rate

#### JEL Classification:

C33, E44, F31

#### DOI:

[10.20885/ejem.vol9.iss1.art10](https://doi.org/10.20885/ejem.vol9.iss1.art10)

### Abstract

The theory of the exchange rate disconnect puzzle provides evidence of the instability of exchange rate relationship with macroeconomic fundamentals. This study will analyse the enactment of the theory of the exchange rate disconnect puzzle with the macroeconomic fundamental phenomenon in affecting the exchange rate movements in the ASEAN-6. The method of analysis Generalized Method of Moment (GMM) with panel data is used to provide an explanation for the existence of the theory of the exchange rate puzzle disconnect. Results the analysis showed the relationship between macroeconomic fundamentals through proxies of the monetary approach affect to exchange rate movements in the ASEAN-6.

### Abstrak

Teori the exchange rate disconnect puzzle memberikan bukti ketidakstabilan hubungan nilai tukar dengan fundamental makroekonomi. Penelitian ini akan menganalisis berlakunya teori the exchange rate disconnect puzzle dengan fenomena fundamental makroekonomi dalam memengaruhi pergerakan nilai tukar di ASEAN-6. Metode analisis Generalized Method of Moment (GMM) dengan data panel digunakan untuk memberikan penjelasan atas eksistensi teori the exchange rate disconnect puzzle. Hasil analisis menunjukkan terdapat hubungan antara fundamental makroekonomi melalui proksi pendekatan moneter berpengaruh terhadap pergerakan nilai tukar di ASEAN-6.

### Introduction

The theory of exchange rate determination explains exchange rate movements which are influenced by macroeconomic conditions (Dornbusch, 1976; Frankel, 1979; Mark & Sul, 2001). Nevertheless, the empirical result does not prove that the exchange rate having a relation to fundamental macroeconomics in both developing and developed countries in different periods (Rapach & Wohar, 2002; Jindrova, 2007; Ko & Ogaki, 2015). Wikanti (2011) suggests that part of the contagion across countries could reach the foreign exchange market through the bond market. The difference between the theory and the empirical results proves that there is an anomaly to the relations of the exchange rate with the fundamental macroeconomics.

Instability relationships of fundamental macroeconomics with the exchange rate is called by the theory of the exchange rate disconnect puzzle (Obstfeld & Rogoff, 2000). The existence of the exchange rate disconnect puzzle theory is described by Jindrova's research in 2007 who determined that variable of macroeconomics was not able to explain a change in exchange rate. In addition, fundamental macroeconomics estimates the exchange rate only in five to ten years (Chen & Chou, 2015). Another explanation is that it was caused by the failure of the exchange rate determinant theory in clarifying the movement of the exchange rate, like a Theory Purchasing Power Parity (PPP) and the theory of Uncovered Interest Parity (UIP) as well as the instability of money demand in the foreign exchange market (Grauwe & Grimaldi, 2002; Jindrova, 2007; Anggarwal, 2013). These conditions provide a proof about the exchange rate disconnect puzzle theory in international economics.

The relationship between the exchange rate and the fundamental macroeconomics has been a topic in a debate. Based on this point, the purpose of this study is to analyse the effect of macroeconomic fundamental to the movement of the exchange rate by using the analysis method of GMM panel on the states of ASEAN-6. The study examines the exchange rate disconnect puzzle theory in the ASEAN-6 countries based on the fluctuating exchange rate movements in the country (Yoshino, Kaji, & Asonuma, 2014).

The difference between this study with that of Lagana & Sgro (2007) and Oskooee, Hosny, & Kishor (2014) is laid on the use of ASEAN-6, instead of in developed countries. The use of GMM panel method is similar to the study of Ojo & Alege (2014) who will provide a proof to the relationship between the exchange rate and variable macroeconomics on the state emerging markets.

### Research Method

Analysis the theory of exchange rate disconnect puzzle in ASEAN-6 countries using GMM panel to eliminate endogeneity in explaining the fluctuations in exchange rates is influenced by fundamental macroeconomics (Ojo & Alege, 2014). Furthermore, the use of GMM panel is as a comparison of study result that has been done by Lagana & Sgro (2007) and Oskooee et al. (2014). The data used, the study methodology and the results will be explained in this section.

The data used in this study is panel data in the form of quarterly data in the period of study from 2001 to 2015. Specifically, it is used for testing the relationship between the exchange rate (NER) in ASEAN-6, namely Indonesia, Singapore, Malaysia, Thailand, The Philippines and Vietnam, and fundamental macroeconomics which is identified as money supply (MS), GDP (Gross Domestic Product), interest rates (INTR) and the use of CPI (Consumer Price Index) as a proxy for inflation (INF). The data was obtained from the central bank of each ASEAN-6, namely Bank Indonesia, Bank Negara Malaysia, Bank of Thailand, Monetary Authority of Singapore, the Bangko Sentral ng Pilipinas and the State Bank of Vietnam. In addition, the data were also taken from the International Monetary Fund (IMF), the Asian Development Bank (ADB) and the World Bank.

The model was applied to explain the effect of the relationship between the exchange rate and fundamentals macroeconomic in this study. The specification of the model used modify the study Oskooee et al. (2014).

$$NER_t = \lambda_0 + \lambda_1 MS_{it} + \lambda_2 GDP_{it} + \lambda_3 INTR_{it} + \lambda_4 INF_{it} + e \quad (1)$$

The use of GMM panel analysis method in this study is transformed into the form of GMM models, as follows (Soto, 2009).

$$NER_{it} = \alpha y_{it-1} + \beta_{i1} MS_{it} + \beta_{i2} GDP_{it} + \beta_{i3} INTR_{it} + \beta_{i4} INF_{it} + \theta_{it} \quad (2)$$

The moment contained in these variables

$$E(e_{it}) = 0$$

$$(NER_{it} - \alpha y_{it-1} - \beta_{i1} MS_{it} + \beta_{i2} GDP_{it} + \beta_{i3} INTR_{it} + \beta_{i4} INF_{it} - \theta_{it}) = 0 \quad (3)$$

Equation (3) is used to estimate the relationship between exchange rate and macroeconomics fundamentals by using GMM panel analysis method. The GMM panel analysis is used to accommodate the presence of endogeneity in the model of the relationship between exchange rate and macroeconomics fundamentals (Ojo & Alege, 2014). In addition, GMM analysis method can be used to estimate a model in a particular time range which there might be behavioral changes on the part of a variable within that time (Wardhono, Salim, & Qoriah, 2014; Wardhono et al., 2015). Changes in these conditions were called as moment stated in parameter  $\theta$ .

This study is started by testing Panel Least Squares model which is aimed to determine the panel model used in estimating the model of GMM panel. The problems appeared such as endogeneity, heteroskedasticity and autocorrelation in the model could not be solved by using panel data method, but then the GMM panel method proposed by Holtz-Eakin, Newey, & Rosen (1998) and developed by Arellano & Bond (1991) called the first difference could solve the problem. However, the use of first difference approach creates a problem in terms of low precision in the model, which could be solved by using the GMM system (Soto, 2009; Heid, Langer, & Larch, 2011). Therefore, to see the relationship between exchange rates and macroeconomics fundamentals with the problems exist, Ojo & Alege (2014) has advised using GMM panel with first difference approach and system GMM.

### Results and Discussion

The relationship between exchange rate and fundamental macroeconomics requires a stationary test of panel data on the variables that are used in the model to ensure no spurious regression occurred (Kao, 1999; Ojo & Alege, 2014). To test data panel stationary, this study uses Levin, Lin, and Chu (LLC) test

from Levin, Lin, & Chu (2002), and Im, Pesaran, and Shin (IPS) Test from Im, Pesaran, & Shin (2003) as well as the Augmented Dickey-Fuller (ADF) test and Philip-Peron (PP) Fisher test from Maddala & Wu (1999). Those tests are used because the data panel used are heterogeneous with the characteristic value of T (time) greater than the value of N (the state).

The root test on table 1 shows that the data employed in this research is stationary in the first different level. The result of LLC, IPS, ADF Fisher and PP Fisher indicates that the probability value is less than  $\alpha=5\%$ . Stationary data is further analysed using Generalized Method of Moments (GMM) method.

**Table 1.** Unit root test in panel data on the first difference level

Variables	Statistical Values	LLC	IPS	ADF-Fisher	PP-Fisher
NER	Statistic	-3,78004	-8,45054	86,2383	196,698
	(prob)	0,0001*	0,0000*	0,0000*	0,0000*
GDP	Statistic	-11,0248	-13,1562	142,724	212,217
	(prob)	0,0000*	0,0000*	0,0000*	0,0000*
MS	Statistic	-5,21526	-4,84752	61,4937	123,004
	(prob)	0,0000*	0,0000*	0,0000*	0,0000*
INTR	Statistic	-8,84067	-8,22820	83,4283	123,667
	(prob)	0,0000*	0,0000*	0,0000*	0,0000*
INF	Statistic	-3,4011	-7,7465	74,4556	91,0544
	(prob)	0,0000*	0,0000*	0,0000*	0,0000*

\* Significant  $\alpha=1\%$ , \*\* significant  $\alpha=5\%$ , \*\*\* significant  $\alpha=10\%$ .

**Table 2.** The result of GMM panel estimation

Variables	Panel Least Square (PLS)	Fixed Effect Model (FEM)	Random Effect Model (REM)	First Difference	System GMM
GDP	0,004*	-0,002	-0,002	-0,093*	0,001
	(2,700)	(-1,17)	(-1,160)	(-3,553)	(0,785)
	[0,007]	[0,242]	[0,246]	[0,000]	[0,432]
	0,273	-0,017	-0,017	-5,070	0,279*
MS	(1,240)	(-1,092)	(-1,646)	(-0,075)	(8,595)
	[0,215]	[0,104]	[0,100]	[0,939]	[0,000]
	0,698*	0,013*	0,013*	9,260	0,011*
	(22,77)	(3,609)	(3,660)	(0,036)	(3,446)
INTR	[0,000]	[0,000]	[0,000]	[0,971]	[0,000]
	0,065	-0,011*	-0,011*	0,002	-0,009*
	(1,565)	(-3,432)	(-3,444)	(1,289)	(-2,680)
	[0,118]	[0,000]	[0,000]	[0,198]	[0,007]
J-Statistic				1,120	1,170
Adjusted R <sup>2</sup>	0,063	0,998	0,056		
F-statistic	158,20	370508,84	6,416		
Prob (F-statistic)	0,000	0,000	0,000		
Chow test	24218,83				
Prob	0,0000				
Hausman test	20.70				
Prob	0,000				
LM test	2606.83				
Breusch-Pagan	0,000				

Significant  $\alpha=1\%$ , \*\* significant  $\alpha=5\%$ , \*\*\* significant  $\alpha=10\%$ .

(...) = t-statistic value

[...] = probability value

The reexamination of exchange rate disconnect puzzle theory on the relation of exchange rates and fundamental macroeconomic using GMM panel proposed by Ojo & Alege (2014) requires prior estimation on panel model. Panel Model test was used to select panel model as the basis to carry out panel GMM estimation. Therefore, Chow Test, Hausman Test, and Lagrange Multiplier Test were applied to determine the best model that would be used.

The analysis the panel model in Table 2, which produces Chow test with probability value of less than 5%, shows that Fixed Effect Model (FEM) is better than Panel Least Square (PLS) model. While test-

ing using Lagrange Multiplier test with probability value of less than 5% points out that using Random Effect Model (REM) is better than using the PLS model. Furthermore, to determine the best model between FEM and REM, Hausman Test is used. The results of Hausman Test generate a probability value of less than 5% which can be inferred that FEM is better than REM.

Fixed Effect Model (FEM) becomes the base of estimating the model of GMM panel by using first difference approach and GMM system. J-statistic value for first difference model is as much as 1,120 smaller than  $X^2 = 79.49^1$  and J-statistic value for system GMM model is 1.70 less than the value  $X^2 = 79.49^1$ , showing that the model in first difference and the GMM system is over identified. The results of GMM panel using first difference approach in Table 2 shows that only GDP variable that has negative significant impact on the exchange rate, while the other variables do not significantly influence the exchange rate. It is due to the problem of the low precision in the model used which can be solved by using system GMM (Soto, 2009; Heid et al., 2011).

In Table 2, Panel GMM estimation using GMM system demonstrates that the variable of money supply has a significant positive relationship on the exchange rate towards that of resulted from probability value of less than 1%. This condition indicates there will be a depreciation of the exchange rate in the ASEAN-6 because of the increase of money supply. The result of GMM Panel estimation on the variable of the money supply is compatible with Mankiw (2012) explanation which states that policy of increasing money supply carried out by the central bank would affect the increase of income and domestic interest rates. Furthermore, it will cause a lot of capital flow out of the economic so that the depreciation of exchange rate happens in a country. Meanwhile, Krugman, Obsfeld, & Melitz (2012), claims that the increase in money supply will lead to an increase in the volume of transactions in the foreign exchange market. These conditions should provide an explanation for the money supply has an important role in the change of the exchange rate in ASEAN-6, which in line with the study by Pozzi & Sadaba (2015).

Interest rate variable has a positive and significant effect on the exchange rate, thus the increase of interest rate would lead to depreciation in the exchange rate in ASEAN-6. These results provide similar evidences to the study by Chow & Kim (2004) that considers the monetary policy through interest rates as an effective policy in influencing the exchange rate, particularly in post-crisis Asia. The relation of interest rate with the exchange rate is supported by Yung's study (2014), which explains that the interest rate can be used as a variable in explaining the movement of the exchange rate of a country. Meanwhile, the estimated results of inflation variable are negative significant as indicated by probability value of less than 1%. It indicates that the increase in inflation will provide an appreciation for the exchange rate. This condition might occur due to the foreign exchange market intervention policy that is effective in keeping the exchange rate in ASEAN than in stabilizing the price. On the other hand, the estimate results on GDP variable showed that it was not significant on the exchange rate with probability value at 10%.

## Conclusion

The latest study examining the relation between macroeconomics fundamental and exchange rate according to the exchange rate disconnect puzzle theory expects that fundamental macroeconomics will able to convey a more stable exchange rates. This study supports the testing using the exchange rate disconnect puzzle theory using GMM panel analysis method in ASEAN-6 countries. Based on the estimated result of GMM analysis method on testing the concept of the exchange rate disconnect puzzle in ASEAN-6 in the period from 2001 until 2015, the concept was unproven since there was a relationship between the exchange rate and macroeconomics fundamental in ASEAN-6. Other results obtained in this study is that the policy that could be used in the ASEAN-6 countries in stabilizing the exchange rate is by implementing foreign exchange market intervention policy, the management of foreign exchange reserves and the management of capital flows. Furthermore, the importance of the exchange rate policy which was driven by the harmonization of monetary and fiscal authorities in each ASEAN-6 countries is always coordinated to stabilize the exchange rate in order to anticipate the turbulence of globalization that had impact on economic integration in ASEAN-6 countries. The achievement of exchange rate stability could be performed through the harmonization of monetary authorities to establish the exchange rate policy which is based on the different regime in each country. It indicates the importance of determining the monetary authority by looking at various aspects to stabilize the exchange rate.

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<sup>1</sup>Source: table  $X^2$  distribution

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